

CLAIMS

What is claimed is:

1 1. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic
3 module comprising:

4 a base;
5 a first horizontal printed circuit board (PCB) arranged
6 horizontally with the base and parallel to a first optical
7 axis of a first optoelectronic device, the first
8 optoelectronic device having terminals coupled to the first
9 horizontal printed circuit board; and

10 a second vertical printed circuit board (PCB) arranged at
11 a perpendicular angle with the base and parallel to a second
12 optical axis of a second optoelectronic device, the second
13 optoelectronic device having terminals coupled to the second
14 vertical printed circuit board.

1 2. The fiber optic module of claim 1 further comprising:
2 a housing coupled to the base.

1 3. The fiber optic module of claim 2 wherein,
2 the housing is a shielded housing to encase the first and
3 second printed circuit boards to reduce electromagnetic
4 interference (EMI).

1 4. The fiber optic module of claim 3 wherein,
2 the housing has an inner septum to separate the fiber
3 optic module into a first side and a second side and the inner
4 septum is a conductive shield to reduce crosstalk
5 electromagnetic radiation.

1 5. The fiber optic module of claim 1 wherein,
2 the base has a first and second opening;
3 the first horizontal printed circuit board has a
4 plurality of pins extending through the first opening in the
5 base to couple to a host printed circuit board; and
6 the second vertical printed circuit board has a plurality
7 of pins extending through the second opening in the base to
8 couple to the host printed circuit board.

1 6. The fiber optic module of claim 5 wherein,
2 the first and second opening in the base are a plurality
3 of pin holes in the base.

1 7. The fiber optic module of claim 5 wherein,
2 the first and second opening in the base are a first and
3 second cutout in the base.

1 8. The fiber optic module of claim 1 wherein, the first
2 horizontal and second vertical printed circuit boards further
3 comprises:

4 electrical components coupled between the first
5 optoelectronic device and the plurality of pins of the first
6 printed circuit board and between the second optoelectronic
7 device and the plurality of pins of the second printed circuit
8 board, the electrical components for controlling the first and
9 second optoelectronic devices.

1 9. The fiber optic module of claim 1 wherein, the first
2 horizontal printed circuit board further comprises:
3 a ground plane to reduce electro-magnetic fields
4 generated by the electrical components.

1 10. The fiber optic module of claim 1 wherein, the second
2 vertical printed circuit board further comprises:
3 a ground plane to reduce electro-magnetic fields
4 generated by the electrical components.

1 11. The fiber optic module of claim 1 further comprising:
2 a first optical block coupled to the first optoelectronic
3 device, the first optical block having a first opening to
4 receive the first optoelectronic device, and
5 a first lens to couple photons between the first
6 optoelectronic device and an optical fiber.

1 12. The fiber optic module of claim 11 further
2 comprising:
3 a nose coupled to the base, the nose to receive an
4 optical fiber connector and to hold an optical fiber
5 substantially fixed and aligned with an optical opening of the
6 optical block.

1 13. The fiber optic module of claim 12 further
2 comprising:
3 a nose shield surrounding the nose to reduce
4 electromagnetic interference.

1 14. The fiber optic module of claim 1 further comprising:
2 a second optical block coupled to the second
3 optoelectronic device, the second optical block having
4 a second opening to receive the second optoelectronic
5 device, and
6 a second lens to couple photons between the second
7 optoelectronic device and an optical fiber.

1 15. The fiber optic module of claim 11 further
2 comprising:
3 a second optical block coupled to the second
4 optoelectronic device, the second optical block having
5 a second opening to receive the second optoelectronic
6 device, and
7 a second lens to couple photons between the second
8 optoelectronic device and an optical fiber.

1 16. The fiber optic module of claim 1 further comprising:
2 an optical block coupled to the first and second
3 optoelectronic devices, the optical block having
4 first and second openings to receive the first and second
5 optoelectronic devices,
6 a first lens to couple photons between the first
7 optoelectronic device and a first optical fiber, and
8 a second lens to couple photons between the second
9 optoelectronic device and a second optical fiber.

1 17. The fiber optic module of claim 16, wherein,
2 the first lens of the optical block to launch photons
3 into the first optical fiber from the first optoelectronic
4 device.

1 18. The fiber optic module of claim 16, wherein,
2 the second lens of the optical block is a focusing lens
3 to receive photons from the second optical fiber and to couple
4 them to the second optoelectronic device.

1 19. The fiber optic module of claim 16 further
2 comprising:

3 a nose coupled to the base, the nose to receive an
4 optical fiber connector and to hold an optical fiber
5 substantially fixed and aligned with an optical opening of the
6 optical block.

1 20. The fiber optic module of claim 19 further
2 comprising:

3 a nose shield surrounding the nose to reduce
4 electromagnetic interference.

1 21. The fiber optic module of claim 13, wherein,
2 the first optoelectronic device is a photodetector.

1 22. The fiber optic module of claim 13, wherein,
2 the second optoelectronic device is an emitter.

1 23. The fiber optic module of claim 22, wherein,
2 the emitter is a vertical cavity surface emitting laser
3 (VCSEL).

1 24. A fiber optic transceiver for coupling photons
2 between optoelectronic devices and optical fibers, the fiber
3 optic transceiver comprising:

4 a base;
5 a first vertical printed circuit board (PCB) arranged at
6 a perpendicular angle with the base and parallel to a first
7 optical axis of a first optoelectronic device, the first
8 vertical printed circuit board having a first connecting means
9 to couple to an external printed circuit board, the first
10 optoelectronic device having terminals coupled to the first
11 vertical printed circuit board;

12 a second slanted printed circuit board (PCB) arranged at

13 an angle with the base and parallel to a second optical axis
14 of a second optoelectronic device, the second slanted printed
15 circuit board having a second connecting means to couple to an
16 external printed circuit board, the second optoelectronic
17 device having terminals coupled to the second slanted printed
18 circuit board;

19 a housing coupled to the base, the housing to cover the
20 first vertical printed circuit board and the second slanted
21 printed circuit board.

1 25. The fiber optic transceiver of claim 24 wherein,
2 the first vertical printed circuit board further
3 comprises:

4 first electrical components coupled between the
5 first optoelectronic device and the first connecting
6 means on a first side of the first internal printed
7 circuit board, the first electrical components for
8 controlling the first optoelectronic device, and

9 a first ground plane coupled to a second side of the
10 first internal printed circuit board to reduce electro-
11 magnetic fields;

12 and,

13 the second slanted printed circuit board further
14 comprises:

15 second electrical components coupled between the second
16 optoelectronic device and the second connecting means on a
17 first side of the second slanted printed circuit board, the
18 second electrical components for controlling the second
19 optoelectronic device.

1 26. The fiber optic transceiver of claim 25 wherein,
2 the second slanted printed circuit board further
3 comprises:

4 a second ground plane coupled to a second side of
5 the second slanted printed circuit board to reduce
6 electro-magnetic fields.

1 27. The fiber optic transceiver of claim 24, wherein,
2 the first connecting means and the second connecting
3 means are pins to couple to pin receptacles of the external
4 printed circuit board.

1 28. The fiber optic transceiver of claim 24, wherein,
2 the first connecting means and the second connecting
3 means are connectors to couple into connectors of the external
4 printed circuit board.

1 29. The fiber optic transceiver of claim 24 further
2 comprising:
3 an optical block coupled to the first optoelectronic
4 device and the second optoelectronic device, the optical block
5 having a first lens to couple photons between the first
6 optoelectronic device and a first optical fiber and a second
7 lens to couple photons between the second optoelectronic
8 device and a second optical fiber.

1 30. The fiber optic transceiver of claim 24 further
2 comprising:
3 a first optical block coupled to the first optoelectronic
4 device, the first optical block having a first lens to couple
5 photons between the first optoelectronic device and a first
6 optical fiber, and
7 a second optical block coupled to the second
8 optoelectronic device, the second optical block having a
9 second lens to couple photons between the second

10 optoelectronic device and a second optical fiber.

1 31. The fiber optic transceiver of claim 24 further
2 comprising:

3 a nose coupled to the base, the nose for receiving an
4 optical fiber connector and holding a pair of optical fibers
5 substantially fixed and aligned with the first optoelectronic
6 device and the second optoelectronic device.

1 32. The fiber optic transceiver of claim 31 further
2 comprising:

3 a nose shield surrounding the nose to reduce
4 electromagnetic interference.

1 33. The fiber optic transceiver of claim 24 further
2 comprising:

3 an internal shield inserted between the first vertical
4 printed circuit board and the second slanted printed circuit
5 board, the internal shield to reduce electrical crosstalk.

1 34. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic
3 module comprising:

4 a base;

5 a first slanted printed circuit board (PCB) arranged on a
6 slanted angle with the base and parallel to a first optical
7 axis of a first optoelectronic device, the first slanted
8 printed circuit board having a ground plane on one side, the
9 first optoelectronic device having terminals coupled to the
10 first slanted printed circuit board;

11 a second vertical printed circuit board (PCB) arranged at
12 a perpendicular angle with the base and parallel to a second

13 optical axis of a second optoelectronic device, the second
14 optoelectronic device having terminals coupled to the second
15 vertical printed circuit board; and
16 a housing coupled to the base.

1 35. The fiber optic module of claim 34 wherein,
2 the housing is a shielded housing to encase the first
3 slanted and second vertical printed circuit boards to reduce
4 electromagnetic interference (EMI).

1 36. The fiber optic module of claim 34 wherein,
2 the second vertical printed circuit board has a ground
3 plane on one side.

1 37. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic
3 module comprising:

4 a base;
5 a first slanted printed circuit board (PCB) arranged on a
6 slanted angle with the base and parallel to a first optical
7 axis of a first optoelectronic device, the first
8 optoelectronic device having terminals coupled to the first
9 slanted printed circuit board; and
10 a second slanted printed circuit board (PCB) arranged on
11 a slanted angle with the base and parallel to a second optical
12 axis of a second optoelectronic device, the second slanted
13 printed circuit board having a ground plane on one side, the
14 second optoelectronic device having terminals coupled to the
15 second vertical printed circuit board; and
16 a housing coupled to the base.

1 38. The fiber optic module of claim 37 wherein,

2 the housing is a shielded housing to encase the first and
3 second printed circuit boards to reduce electromagnetic
4 interference (EMI).

1 39. The fiber optic module of claim 37 wherein,
2 the first slanted printed circuit board has a ground
3 plane on one side.

1 40. A fiber optic module comprising:
2 a first optical block having a first opening to receive a
3 first optoelectronic device;
4 the first optoelectronic device coupled into the first
5 opening;
6 a second optical block having a second opening to receive
7 a second optoelectronic device;
8 the second optoelectronic device coupled into the second
9 opening;
10 a first printed circuit board coupled to terminals of the
11 first optoelectronic device in parallel with a plane of the
12 first optical block, the first printed circuit board parallel
13 to a first optical axis of the first optoelectronic device;
14 and
15 a second printed circuit board coupled to terminals of
16 the second optoelectronic device perpendicular with a plane of
17 the second optical block, the second printed circuit board
18 parallel to a second optical axis of the second optoelectronic
19 device.

1 41. The fiber optic module of claim 40, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a transmitter to
4 couple photons into a first optical fiber, and
5 the second optoelectronic device is a receiver to receive

6 photons from a second optical fiber.

1 42. The fiber optic module of claim 40, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a receiver to receive
4 photons from a first optical fiber, and
5 the second optoelectronic device is a transmitter to
6 couple photons into a second optical fiber.

1 43. A fiber optic module comprising:
2 an optical block having a first opening to receive a
3 first optoelectronic device and a second opening to receive a
4 second optoelectronic device;
5 the first optoelectronic device coupled into the first
6 opening;
7 the second optoelectronic device coupled into the second
8 opening;
9 a base having a first guide rail;
10 a first vertical printed circuit board coupled to
11 terminals of the first optoelectronic device in parallel to a
12 first optical axis of the first optoelectronic device, the
13 first vertical printed circuit board coupled to the first
14 guide rail of the base perpendicular with the base; and
15 a second horizontal printed circuit board coupled to
16 terminals of the second optoelectronic device in parallel to a
17 second optical axis of the second optoelectronic device, the
18 second horizontal printed circuit board parallel to the base.

1 44. The fiber optic module of claim 43 further
2 comprising:
3 a housing coupled to the base.

1 45. The fiber optic module of claim 44 wherein,
2 the housing is a shielded housing to encase the first
3 vertical and second horizontal printed circuit boards to
4 reduce electromagnetic interference (EMI).

1 46. The fiber optic module of claim 43 wherein,
2 the base has a pair of cutouts to allow pins of the first
3 vertical printed circuit board and pins of the second
4 horizontal printed circuit board to extend through.

1 47. The fiber optic module of claim 43 wherein,
2 the base has a pair of openings to allow pins of the
3 first vertical printed circuit board and pins of the second
4 horizontal printed circuit board to extend through.

1 48. The fiber optic module of claim 43, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a transmitter to
4 couple photons into a first optical fiber, and
5 the second optoelectronic device is a receiver to receive
6 photons from a second optical fiber.

1 49. The fiber optic module of claim 43, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a receiver to receive
4 photons from a first optical fiber, and
5 the second optoelectronic device is a transmitter to
6 couple photons into a second optical fiber.

1 50. A fiber optic module comprising:
2 an optical block having a first opening to receive a

3 first optoelectronic device and a second opening to receive a
4 second optoelectronic device;

5 the first optoelectronic device coupled into the first
6 opening;

7 the second optoelectronic device coupled into the second
8 opening;

9 a base having a pair of brackets on one side;

10 a first vertical printed circuit board coupled to
11 terminals of the first optoelectronic device in parallel to a
12 first optical axis of the first optoelectronic device, the
13 first vertical printed circuit board coupled to the pair of
14 brackets of the base; and

15 a second horizontal printed circuit board coupled to
16 terminals of the second optoelectronic device in parallel to a
17 second optical axis of the second optoelectronic device, the
18 second horizontal printed circuit board parallel to the base.

1 51. The fiber optic module of claim 50 further
2 comprising:

3 a housing coupled to the base.

1 52. The fiber optic module of claim 50 wherein,
2 the housing is a shielded housing to encase the first
3 vertical and second horizontal printed circuit boards to
4 reduce electromagnetic interference (EMI).

1 53. The fiber optic module of claim 50 wherein,
2 the base has a pair of cutouts to allow pins of the first
3 vertical printed circuit board and pins of the second
4 horizontal printed circuit board to extend through.

1 54. The fiber optic module of claim 50 wherein,

2 the base has a pair of openings to allow pins of the
3 first vertical printed circuit board and pins of the second
4 horizontal printed circuit board to extend through.

1 55. The fiber optic module of claim 50, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a transmitter to
4 couple photons into a first optical fiber, and
5 the second optoelectronic device is a receiver to receive
6 photons from a second optical fiber.

1 56. The fiber optic module of claim 50, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a receiver to receive
4 photons from a first optical fiber, and
5 the second optoelectronic device is a transmitter to
6 couple photons into a second optical fiber.

1 57. A fiber optic module comprising:
2 an optical block having a first opening to receive a
3 first optoelectronic device and a second opening to receive a
4 second optoelectronic device, the optical block further having
5 a first slot to receive an end of a first vertical printed
6 circuit board and a second slot to receive an end of a second
7 horizontal printed circuit board;
8 the first optoelectronic device coupled into the first
9 opening;
10 the second optoelectronic device coupled into the second
11 opening;
12 a base;
13 the first vertical printed circuit board coupled to
14 terminals of the first optoelectronic device in parallel to a
15 first optical axis of the first optoelectronic device, the

16 first vertical printed circuit board coupled to the first slot
17 of the optical block perpendicular with the base; and
18 the second horizontal printed circuit board coupled to
19 terminals of the second optoelectronic device in parallel to a
20 second optical axis of the second optoelectronic device, the
21 second horizontal printed circuit board coupled to the second
22 slot of the optical block in parallel with the base.

1 58. The fiber optic module of claim 57 further
2 comprising:
3 a housing coupled to the base.

1 59. The fiber optic module of claim 58 wherein,
2 the housing is a shielded housing to encase the first
3 vertical and second horizontal printed circuit boards to
4 reduce electromagnetic interference (EMI).

1 60. The fiber optic module of claim 57 wherein,
2 the base has a pair of cutouts to allow pins of the first
3 vertical printed circuit board and pins of the second
4 horizontal printed circuit board to extend through.

1 61. The fiber optic module of claim 57 wherein,
2 the base has a pair of openings to allow pins of the
3 first vertical printed circuit board and pins of the second
4 horizontal printed circuit board to extend through.

1 62. The fiber optic module of claim 57, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a transmitter to
4 couple photons into a first optical fiber, and
5 the second optoelectronic device is a receiver to receive

6 photons from a second optical fiber.

1 63. The fiber optic module of claim 57, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a receiver to receive
4 photons from a first optical fiber, and
5 the second optoelectronic device is a transmitter to
6 couple photons into a second optical fiber.

1 64. A fiber optic module comprising:
2 an optical block having a first opening to receive a
3 first optoelectronic device and a second opening to receive a
4 second optoelectronic device;
5 the first optoelectronic device coupled into the first
6 opening;
7 the second optoelectronic device coupled into the second
8 opening;
9 a base;
10 a slanted printed circuit board (PCB) coupled to
11 terminals of the first optoelectronic device in parallel to a
12 first optical axis of the first optoelectronic device, the
13 slanted printed circuit board arranged at an angle to slant
14 inward from the base; and
15 a vertical printed circuit board (PCB) coupled to
16 terminals of the second optoelectronic device in parallel to a
17 second optical axis of the second optoelectronic device, the
18 vertical printed circuit board arranged at a perpendicular
19 angle with the base.

1 65. The fiber optic module of claim 64 further
2 comprising:
3 a housing coupled to the base.

1 66. The fiber optic module of claim 65 wherein,
2 the housing is a shielded housing to encase the first
3 slanted and second vertical printed circuit boards to reduce
4 electromagnetic interference (EMI).

1 67. The fiber optic module of claim 65 wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a plurality of pins to couple
4 to a host system printed circuit board.

1 68. The fiber optic module of claim 67 wherein,
2 the base has a pair of cutouts to allow the pins of the
3 slanted printed circuit board and the pins of the vertical
4 printed circuit board to extend through.

1 69. The fiber optic module of claim 67 wherein,
2 the base has a pair of openings to allow the pins of the
3 slanted printed circuit board and the pins of the vertical
4 printed circuit board to extend through.

1 70. The fiber optic module of claim 64, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a transmitter to
4 couple photons into a first optical fiber, and
5 the second optoelectronic device is a receiver to receive
6 photons from a second optical fiber.

1 71. The fiber optic module of claim 64 wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a connector to couple to a
4 connector of a host system printed circuit board.

1 72. The fiber optic module of claim 64 further
2 comprising:
3 a housing having an opening at an end coupled to the
4 base.

1 73. The fiber optic module of claim 72, wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a connector to couple to a
4 connector of a host system printed circuit board through the
5 opening at the end of the housing.

1 74. The fiber optic module of claim 64 wherein,
2 the base includes an inner septum to separate the fiber
3 optic module into a first side and a second side.

1 75. A fiber optic module comprising:
2 an optical block having a first opening to receive a
3 first optoelectronic device and a second opening to receive a
4 second optoelectronic device;
5 the first optoelectronic device coupled into the first
6 opening;
7 the second optoelectronic device coupled into the second
8 opening;
9 a base;
10 a slanted printed circuit board (PCB) coupled to
11 terminals of the first optoelectronic device in parallel to a
12 first optical axis of the first optoelectronic device, the
13 slanted printed circuit board arranged at an angle to slant
14 outward from the base; and
15 a vertical printed circuit board (PCB) coupled to
16 terminals of the second optoelectronic device in parallel to a

17 second optical axis of the second optoelectronic device, the
18 vertical printed circuit board arranged perpendicular to the
19 base.

1 76. The fiber optic module of claim 75 further
2 comprising:
3 a housing coupled to the base.

1 77. The fiber optic module of claim 76 wherein,
2 the housing is a shielded housing to encase the slanted
3 and vertical printed circuit boards to reduce electromagnetic
4 interference (EMI).

1 78. The fiber optic module of claim 75 wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a pin header with a plurality
4 of pins to couple to a host system printed circuit board.

1 79. The fiber optic module of claim 75 wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a plurality of pins to couple
4 to a host system printed circuit board.

1 80. The fiber optic module of claim 79 wherein,
2 the base has a pair of cutouts to allow the pins of the
3 slanted printed circuit board and the pins of the vertical
4 printed circuit board to extend through.

1 81. The fiber optic module of claim 79 wherein,
2 the base has a pair of openings to allow the pins of the
3 slanted printed circuit board and the pins of the vertical
4 printed circuit board to extend through.

1 82. The fiber optic module of claim 75, wherein the fiber
2 optic module is a fiber optic transceiver and
3 the first optoelectronic device is a transmitter to
4 couple photons into a first optical fiber, and
5 the second optoelectronic device is a receiver to receive
6 photons from a second optical fiber.

1 83. The fiber optic module of claim 75 wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a connector to couple to a
4 connector of a host system printed circuit board.

1 84. The fiber optic module of claim 75 further
2 comprising:
3 a housing having an opening at an end coupled to the
4 base.

1 85. The fiber optic module of claim 84, wherein,
2 the slanted printed circuit board and the vertical
3 printed circuit board each have a connector to couple to a
4 connector of a host system printed circuit board through the
5 opening at the end of the housing.

1 86. The fiber optic module of claim 75 wherein,
2 the base includes an inner septum to separate the fiber
3 optic module into a first side and a second side.

1 87. The fiber optic module of claim 75 further
2 comprising:
3 a housing having an inner septum to separate the fiber
4 optic module into a first side and a second side, the housing

5 coupled to the base.

1 88. The fiber optic module of claim 87 wherein,
2 the housing is a conductive shielded housing to encase
3 the slanted and vertical printed circuit boards to reduce
4 electromagnetic interference (EMI) and the septum is a
5 conductive shield to reduce crosstalk electromagnetic
6 radiation.

1 89. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic
3 module comprising:

4 a horizontal printed circuit board (PCB) arranged
5 horizontally having a first plurality of pins and a second
6 plurality of pins to couple to a host printed circuit board;
7 a first vertical printed circuit board (PCB) coupled to
8 the horizontal printed circuit board arranged at a
9 perpendicular angle and parallel to a first optical axis of a
10 first optoelectronic device, the first optoelectronic device
11 having terminals coupled to the first vertical printed circuit
12 board.

13 a second vertical printed circuit board (PCB) coupled to
14 the horizontal printed circuit board arranged at a
15 perpendicular angle and parallel to a second optical axis of a
16 second optoelectronic device, the second optoelectronic device
17 having terminals coupled to the second vertical printed
18 circuit board; and

19 a housing coupled to the horizontal printed circuit
20 board.

1 90. The fiber optic module of claim 89 wherein,
2 the housing is a shielded housing to encase the
3 horizontal and the first and the second vertical printed

4 circuit boards to reduce electromagnetic interference (EMI).

1 91. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic
3 module comprising:

4 a base having a first opening and a second opening;
5 a horizontal printed circuit board (PCB) arranged
6 horizontally having a first plurality of pins protruding
7 through the first opening and a second plurality of pins
8 protruding through the second opening to couple to a host
9 printed circuit board;

10 a first vertical printed circuit board (PCB) coupled to
11 the horizontal printed circuit board arranged at a
12 perpendicular angle and parallel to a first optical axis of a
13 first optoelectronic device, the first optoelectronic device
14 having terminals coupled to the first vertical printed circuit
15 board.

16 a second vertical printed circuit board (PCB) coupled to
17 the horizontal printed circuit board arranged at a
18 perpendicular angle and parallel to a second optical axis of a
19 second optoelectronic device, the second optoelectronic device
20 having terminals coupled to the second vertical printed
21 circuit board; and

22 a housing coupled to the horizontal printed circuit
23 board.

1 92. The fiber optic module of claim 91 wherein,
2 the housing is a shielded housing to encase the
3 horizontal and the first and the second vertical printed
4 circuit boards to reduce electromagnetic interference (EMI).

1 93. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic

3 module comprising:

4 a horizontal printed circuit board (PCB) arranged
5 horizontally having a first plurality of pins and a second
6 plurality of pins to couple to a host printed circuit board
7 and a first optoelectronic device having terminals coupled to
8 the horizontal printed circuit board.

9 a vertical printed circuit board (PCB) coupled to the
10 horizontal printed circuit board arranged at a perpendicular
11 angle and parallel to a second optical axis of a second
12 optoelectronic device, the second optoelectronic device having
13 terminals coupled to the vertical printed circuit board; and

14 a housing coupled to the horizontal printed circuit
15 board.

1 94. The fiber optic module of claim 93 wherein,
2 the housing is a shielded housing to encase the
3 horizontal and the vertical printed circuit boards to reduce
4 electromagnetic interference (EMI).

1 95. The fiber optic module of claim 93 wherein,
2 the horizontal printed circuit board is arranged parallel
3 to a first optical axis of the first optoelectronic device.

1 96. A fiber optic module for coupling photons between
2 optoelectronic devices and optical fibers, the fiber optic
3 module comprising:

4 a base having a first opening and a second opening;
5 a horizontal printed circuit board (PCB) arranged
6 horizontally having a first plurality of pins protruding
7 through the first opening and a second plurality of pins
8 protruding through the second opening to couple to a host
9 printed circuit board and a first optoelectronic device having
10 terminals coupled to the horizontal printed circuit board.

11 a vertical printed circuit board (PCB) coupled to the
12 horizontal printed circuit board arranged at a perpendicular
13 angle and parallel to a second optical axis of a second
14 optoelectronic device, the second optoelectronic device having
15 terminals coupled to the vertical printed circuit board; and
16 a housing coupled to the base.

1 97. The fiber optic module of claim 96 wherein,
2 the housing is a shielded housing to encase the
3 horizontal and the vertical printed circuit boards to reduce
4 electromagnetic interference (EMI).

1 98. The fiber optic module of claim 96 wherein,
2 the horizontal printed circuit board is arranged parallel
3 to a first optical axis of the first optoelectronic device.